

# First g factor Measurement using a Radioactive $^{76}\text{Kr}$ Beam<sup>1</sup>

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Magnetic moments of individual excited states and, in particular, their variation as a function of spin and energy in any nucleus, or across a range of N or Z in neighboring nuclei can provide significant information on the structure of nuclei. Employing projectile excitation in inverse kinematics makes it possible to measure magnetic moments with high accuracy to yield good microscopic information on the wave functions of the nuclear states involved. This technique is particularly well-suited for studying unstable isotopes using radioactive beams.

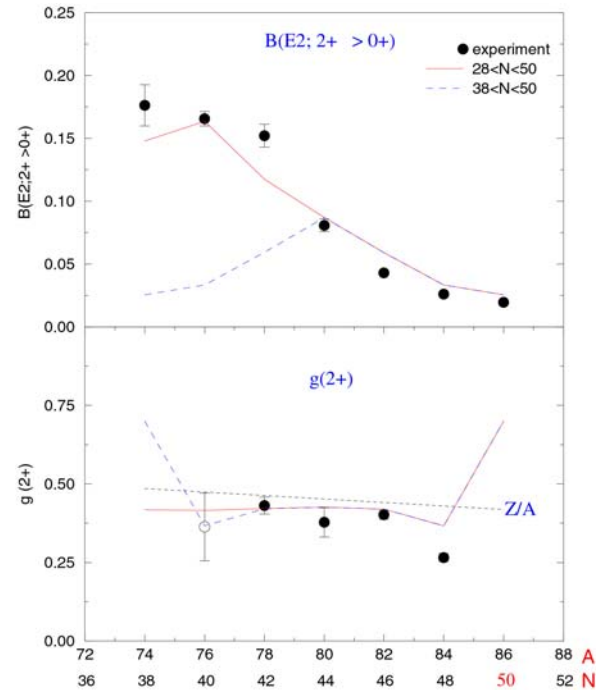
The recent g-factor measurements of excited states in the stable even mass Kr isotopes [2] stimulated interest in extending the systematic studies to the lighter radioactive Kr isotopes. The IBA-II descriptions yield g factors that differ substantially from the collective Z/A value for only the radioactive Kr nuclei. The radioactive even  $^{72,74,76}\text{Kr}$  belong to the class of nuclei with N=Z where both neutrons and protons occupy the same orbitals and hence may provide evidence for neutron-proton pairing correlations. This experiment is the first attempt to use the transient magnetic field technique to measure the magnetic moment of a radioactive nucleus, in this case  $^{76}\text{Kr}$  [ $T_{1/2} = 14.8\text{h}$ ]

The  $^{76}\text{Kr}$  beam was produced in batch mode as described in the preceding paper. Three batches were produced for the g-factor measurement. The multi-layer target was the same one used in the previous g-factor experiments with krypton, consisting of 0.9 mg/cm<sup>2</sup> enriched  $^{26}\text{Mg}$  evaporated on a 4.0 mg/cm<sup>2</sup> gadolinium layer itself deposited on a 1.1 mg/cm<sup>2</sup> tantalum foil., backed by a 3.9 mg/cm<sup>2</sup> thick copper layer. The Gd layer was magnetized by an external magnetic field of 0.06 T applied in a direction perpendicular to the  $\gamma$ -ray detection plane, either up or down. The set up was modified to mount a 8-mm tape cartridge made of 15  $\mu\text{m}$  thick polyethylene 2 mm behind the target. The tape moved at 8 cm/min in order to remove the stopped beam from the target area.

The Kr ions that were Coulomb excited in the Mg layer were exposed to the transient magnetic field in the Gd layer before stopping in the Cu backing. The beam itself traversed the Cu layer and stopped in the moving tape. A solar cell particle detector at 0° - covering  $\pm 31^\circ$  in the vertical direction and  $\pm 9^\circ$  in the horizontal direction – detected the recoiling Mg ions. For the precession measurements, deexcitation  $\gamma$ -rays were detected in coincidence with the forward scattered Mg ions in four Clover Ge detectors placed 12.2 cm from the target at  $\pm 67^\circ$  and  $\pm 113^\circ$  with respect to the beam.

The coincidence requirement gains added importance when working with a radioactive beam because it is used to subtract the random contributions due to activity buildup in the target area. The measurement of the angular correlation and precession of the  $^{76}\text{Kr}$ , when compared with  $^{78}\text{Kr}$  measured under the same conditions, allow the determination of the magnetic moment.

The experimental and calculated B(E2) values and g-factors are shown in Figure 1 for the even krypton isotopes, with our new data point for  $^{76}\text{Kr}$  shown as an open circle. The result confirms the collective nature of the structure of the  $2_1^+$  state of  $^{76}\text{Kr}$ . Future experiments on lighter Kr isotopes, with higher statistical accuracy, should help map out the nature of the collective excitations in this region.



**Figure 1.** B(E2) values in  $e^2b^2$  and g factors for even Kr isotopes. The new  $^{76}\text{Kr}$  point is shown as an open circle. The curves are IBA-II calculations [2] assuming shell closure for N = 28 or 38.

## References

- [1] LBNL-55196, Kumbartzki, et al. Phys Lett B, in press
- [2] T.J. Mertzimekis, et al., Phys Rev **C64** 024314 (2001)